Non-parametric modelling of a rectangular flexible plate structure

Abstract:

This research investigates the performance of dynamic modelling using non-parametric techniques for identification of a flexible structure system for development of active vibration control. In this paper, the implementation details are described and the experimental studies conducted in this research are analysed. The input–output data of the system were first acquired through the experimental studies using National Instruments (NI) data acquisition system. A sinusoidal force was applied to excite the flexible plate and the dynamic response of the system was then investigated. Non-parametric modelling of the system were developed using several artificial intelligent methodologies namely Adaptive Elman Neural Networks (ENN), Backpropagation Multi-layer Perceptron Neural Networks (MLPNN) and Adaptive Neuro-Fuzzy Inference System (ANFIS). The performance of all these methodologies were compared and discussed. Finally, validation and verification of the obtained model was conducted using One Step Ahead (OSA) prediction, mean squared error (MSE) and correlation tests. The prediction ability of the model was further observed with unseen data. The results verified that the MLPNN converge to an optimum solution faster and the dynamic model obtained described the flexible plate structure very well. The non-parametric models of the flexible plate structure thus developed and validated will be used as the representation of the transfer function of the system in subsequent investigations for the development of active vibration control strategies for vibration suppression in flexible structures.